

Patent Claims

1. A method for checking whether an input data record is in a working range of a neural network, comprising the following steps:
 - (a) storing training input data records for the neural network, forming a convex envelope being formed by means of the training input data records,
 - (b) checking whether the input data record is in the convex envelope.
2. The method according to Claim 1, further comprising the steps:
 - (c) selecting a number $(d + 1)$ of non-collinear points from the set of training input records,
 - (d) forming a first simplex (S_1) from the selected points,
 - (e) selecting a point (x_l) from the interior of the first simplex (S_l),
 - (f) definition of a path between the input data record and the selected point,
 - (g) checking whether there is an intersection point (x_{l+1}) between the path and a facet of the first simplex, and
 - (h) checking whether a second simplex (S_{l+1}) which contains the intersection point and a section of the path can be formed from the number of points from the training input data records.
3. The method according to Claim 2, further comprising the steps for checking whether a second simplex may be formed:
 - (i) determining vertices of a facet of the first simplex on which the intersection point is located,
 - (j) selecting a further, non-collinear point from the training input data records,
 - (k) forming a simplex (S') from the vertices and the further point,
 - (l) checking whether the simplex contains a section of straight line, and outputting the simplex as a second simplex, if this is the case,
 - (m) exchanging the further point for another, non-collinear point from the set of training input data records and renewed checking.

4. The method according to Claim 1, it is checked whether there is a hyper-plane which contains the input data record so that all the training input data records are located on one side of the hyper-plane.

5. The method according to Claim 4, wherein a minimum of F being searched for in order to check whether a hyper-plane exists, where

$$F = -\min \left(\frac{k \cdot r_i}{|k|} \right)$$

and where the hyper-plane is represented by the normal vector k and $r_i = p_i - x$, where x is the point defined by the input data record.

6. The method according to Claim 1, further comprising the additional steps of:

selecting an initial vector $\lambda^{(0)} = (\lambda_1, \dots, \lambda_n)$ with $\lambda_1 + \dots + \lambda_n = 1$ and

$\lambda_j \geq 0$ ($j=1, \dots, n$), where preferably $\lambda_j = \frac{1}{n}$ is selected,

selecting a matrix M in such a way that the lines matrix $\hat{P}^{(i)} := M \cdot P^{(i)}$ are orthonormed,

calculating $\lambda = \lambda^{(i)} + \hat{P}^{(i)T} \cdot (\hat{x} - \hat{x}^{(i)})$, where $\hat{x}^{(i)} := \hat{P}^{(i)} \lambda^{(i)}$,

checking whether all $\lambda_j \geq 0$ (for $j=1, \dots, n$),

deleting all components from the matrix $P^{(i)}$ and from the vector $\lambda^{(i)}$, which infringe the secondary condition $\lambda_j \geq 0$ (for $j=1, \dots, n$),

renewed calculating of λ .

7. A system for determining at least one predicted value, comprising
at least one neural network which has been trained using a set of training input data records,
means for checking whether one of the input data record for the neural network is in the convex envelope which is formed by the training input data records.

8. The system according to Claim 7, further comprising a hybrid model which contains at least a first neural network and a second neural network, the first neural network having been trained using a set of first training input data records, and the second neural network having been trained using a set of second training input data records, the checking means being embodied in such a way that for a first input data record for the first neural network it is checked whether the first input data record is in the convex envelope which is formed by the first training input data records, and that it is checked for a second input data record for the second neural network whether the second input data record is in the convex envelope which is formed by the second training input data records, the assignment of the first input data record to the first neural network and the assignment of the second input data record to the second neural network being carried out in automated fashion from a composite data record.

9. The system according to Claim 8, wherein the checking means being embodied in such a way that the checking is carried out in accordance with a method according to Claim 1.

10. A computer digital storage medium program product for carrying out a method according to Claim 1.